

In the Drawings:

The attached sheets of Formal Drawings replace the previous drawings.

REMARKS

The Office Action mailed December 13, 2005, has been received and reviewed. Claims 31 through 48 are currently pending in the application. Claims 31 through 48 stand rejected and Claims 33 through 39, 41 through 44 and 46 through 48 have been objected to. Applicants have amended claims 31, 33-38 and 40-48. Claim 39 has been canceled and incorporated into claim 31. Claims 22-28, 41-44 and 45-48 have been amended to replace the term “a” (or an equivalent) with the equivalent term “the.” Thus, the scope of these claims with respect to this term remains undiminished. Reconsideration is respectfully requested.

35 U.S.C. § 102(e) Anticipation Rejections

Anticipation Rejection Based on U.S. Patent No. 5,780,908 to Sekiguchi et al.

Claims 31 through 34, 36 through 38, 40 through 44 and 45 through 48 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Sekiguchi et al. (U.S. Patent No. 5,780,908). Applicants respectfully traverse this rejection, as hereinafter set forth.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Sekiguchi discloses a semiconductor apparatus with a tungsten nitride barrier layer. After the formation of the tungsten nitride barrier layer, an aluminum alloy layer is deposited thereover. (Abstract). The formation of the barrier layer prevents the formation of a tungsten-aluminum alloy which has a high resistance which is undesirable for an interconnection. (Sekiguchi, col. 3, lines 26-30). Applicants respectfully submit that Sekiguchi fails to disclose every element of the presently claimed invention.

Claim 31 of the presently claimed invention recites a “method of reducing oxidation of an electrically conductive material, comprising: forming a first dielectric layer on a semiconductor structure, the first dielectric layer comprising a depression therein; filling the depression with an unoxidized electrically conductive material; reacting a chemical composition with an upper

surface of the electrically conductive material to form a chemical compound more resistant to oxidation than the electrically conductive material; and forming a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric layer to the electrically conductive material.” Support for the amendment may be found throughout the as-filed specification, including claim 39. The limitations of claim 39 have been rewritten in positive method language in claim 31. Applicants respectfully submit that Sekiguchi fails to teach, either expressly or inherently, “forming a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric layer to the electrically conductive material.” Instead, Sekiguchi teaches forming an aluminum alloy layer over a tungsten plug. (Sekiguchi, col. 12, lines 38-43; FIG. 3(c)). As Sekiguchi fails to teach, either expressly or inherently, every element of the presently claimed invention, claim 31 is not anticipated by Sekiguchi. Accordingly, claim 31 is allowable.

Claims 32 through 34 and 36 through 38 are each allowable as depending, either directly or indirectly, from allowable claim 31.

Independent claims 40 and 45 are both allowable at least for the same reasons stated for independent claim 31. Independent claims 40 and 45 both include similar recitation of “forming a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric layer to the electrically conductive material.” As stated, Sekiguchi fails to teach this limitation. Accordingly, claims 40 and 45 of the presently claimed invention are allowable.

Claims 41 through 44 are each allowable as depending, either directly or indirectly, from allowable claim 40.

Claims and 46 through 48 are each allowable as depending, either directly or indirectly, from allowable claim 45.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,780,908 to Sekiguchi et al. in view of U.S. Patent No. 6,114,238 to Liao

Claim 39 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Sekiguchi et al. (U.S. Patent No. 5,780,908) in view of Liao (U.S. Patent No. 6,114,238). Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

The discussion of Sekiguchi is incorporated herein. Liao discloses a self-aligned metal nitride for copper passivation. A metal plug 104 is deposited in a hole in a dielectric layer 102. Prior art methods included depositing a second dielectric layer 108 over the metal plug 104. However, this lead to reliability problems. (Liao, col. 1, line 34-39). Therefore, Liao discloses a second metal layer 212a over the metal plug 208 before further processing. The second metal layer 212a functions as a barrier layer. (Liao, col. 1, lines 41-45).

Claim 39 has been canceled and incorporated into claim 31. Applicants respectfully submit that claim 31 is not rendered obvious by the combination of Sekiguchi in view of Liao. Claim 31 of the presently claimed invention recites a "method of reducing oxidation of an electrically conductive material, comprising: forming a first dielectric layer on a semiconductor structure, the first dielectric layer comprising a depression therein; filling the depression with an unoxidized electrically conductive material; reacting a chemical composition with an upper surface of the electrically conductive material to form a chemical compound more resistant to oxidation than the electrically conductive material; and forming a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric

layer to the electrically conductive material.” No motivation exists to combine the references to teach all of the limitations of claim 31 of the presently claimed invention. No motivation exists to eliminate the barrier layer 212a of Liao, to react “a chemical composition with an upper surface of the electrically conductive material to form a chemical compound more resistant to oxidation than the electrically conductive material” and to form “a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric layer to the electrically conductive material.” Instead, Liao teaches the barrier layer 212a is important to prevent diffusion of copper from metal plug 208. There is no teaching or suggestion in Sekiguchi that exposing the Liao copper plug to nitrogen gas will create an effective barrier. Similarly, no motivation exists in either reference to modify Sekiguchi to form a second dielectric layer over the electrically conductive material and the first dielectric layer and adhering the second dielectric layer to the electrically conductive material. Instead, Sekiguchi discloses an aluminum alloy is adhered to the tungsten plug.

As no motivation exists to combine the cited references, Sekiguchi in view of Liao cannot render claim 31 obvious. Accordingly, claim 31 is allowable.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 5,780,908 to Sekiguchi et al.

Claim 35 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Sekiguchi et al. (U.S. Patent No. 5,780,908). Applicants respectfully traverse this rejection, as hereinafter set forth.

The nonobviousness of independent claim 31 precludes a rejection of claim 35 which depends therefrom because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03. Therefore, the Applicants request that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection to claim 35.

Claim Objections

Claims 33 through 39, 41 through 44 and 46 through 48 are objected to due to informalities in the claim language. Claim 39 has been canceled. Appropriate correction has been made to the remaining claims.

ENTRY OF AMENDMENTS

The amendments to claims above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application.

CONCLUSION

Claims 31-38 and 40- 48 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,



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Attachments: Replacement Formal Drawings (3 Sheets, 5 Figures)

Document in ProLaw